

SPRITE: A TPS Test Bed for Ground and Flight

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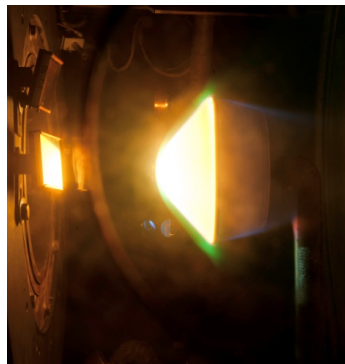
Engineers in the Entry Systems and Technology Division at NASA Ames Research Center developed a fully instrumented, small atmospheric entry probe called SPRITE (**S**mall **P**robe **R**entry **I**nvestigation for **T**PS **E**ngineering). SPRITE, conceived as a flight test bed for thermal protection materials, was tested at full scale in an arc-jet facility so that the aerothermal environments the probe experiences over portions of its flight trajectory and in the arc-jet are similar. This ground-to-flight traceability enhances the ability of mission designers to evaluate margins needed in the design of thermal protection systems (TPS) of larger scale atmospheric entry vehicles.

SPRITE is a 14-inch diameter, 45° sphere-cone with a conical aftbody and designed for testing in the NASA Ames Aerodynamic Heating Facility (AHF). The probe is a two-part aluminum shell with PICA (phenolic impregnated carbon ablator) bonded on the forebody and LI-2200 (Shuttle tile material) bonded to the aftbody. Plugs with embedded thermocouples, similar to those installed in the heat shield of the Mars Science Laboratory (MSL), and a number of distributed sensors are integrated into the design. The data from these sensors are fed to an innovative, custom-designed data acquisition system also integrated with the test article.

Two identical SPRITE models were built and successfully tested in late 2010-early 2011, and the concept is currently being modified to enable testing of conformable and/or flexible materials.



SPRITE model prior to testing in a plasma flow



SPRITE model in plasma flow



SPRITE model after exposure to plasma flow